SLR2000: current status & issues being worked

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Khz ranging session
ILRS Workshop at Eastbourne
October 2005

Progress since Workshop in June 2004
(glacial – but in a positive direction)

- Point-ahead of transmit using Risley Prisms: checked out and working.

- Transceiver transformations documented (McGarry & Degnan, independently), verified, and parameters determined.

- New SigmaSpace Beam Expander and Iris are in the system, aligned and in the software. Both still need final checkout in the system.

- New photon-counting optical alignment technique using stars appears to do a better job of distributing light over the quadrants uniformly. Very important for closed-loop tracking.

- Replaced original detector with spare – appeared to have degraded.

- Started automated closed-loop tracking – some success – some problems.

Work on SLR2000 was extremely slow March – September 2005
due to work on Transponder experiments

Currently ongoing SLR2000 work

- SigmaSpace is working on design to optically shutter the detector.

- We are working on technique to change laser PRF to prevent collisions between outgoing & incoming pulses. Currently we are just blanking electronically.

- We plan to purchase a higher QE 4QMCP detector from Hamamatsu.

- We have analyzed the closed-loop tracking data and need to make some adjustments in the system.

Future work

- SLR2000 has been selected as primary ground station for LRO laser uplink. Will require the purchase of a higher energy 28Hz laser.

Issues related to khz ranging

Closed loop tracking: sometime it works and sometimes it doesn't!

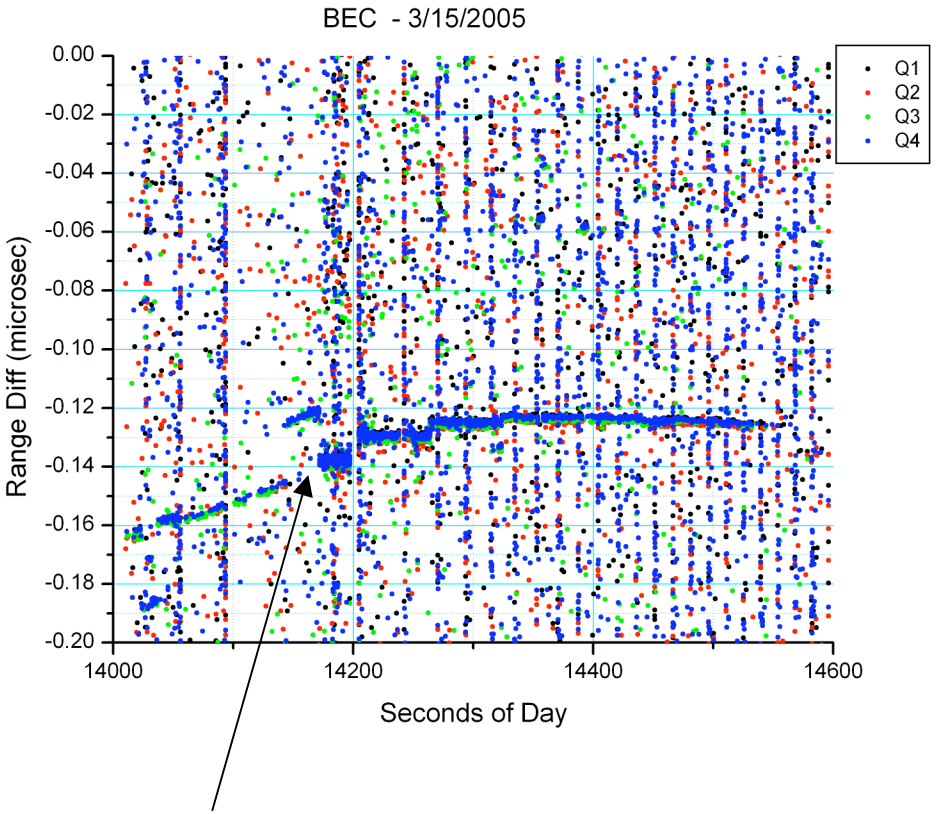
- It is very important to get a uniform distribution of background noise across the four detectors and it is not easy. Probably need to use a software calibration of the quadrant levels to provide final correction.

- Signal must be centered on quadrants when telescope is directly pointed at target. Degnan conjectures that point-ahead may be causing backscattered light to favor one quadrant over others. This does appear to be happening in some of the passes, but not in others. ???

- We have a serious backscatter problem in SLR2000 which is causing problems in a lot of areas, but especially in degradation of the detector and most likely also in the closed-loop tracking. We must drastically reduce the backscatter effects through optical blanking and by changing the laser PRF.

Still not able to range to LAGEOS

- Returns from all satellites are generally weaker than theoretical.
- Until new beam expander, system wasn't properly focused, beam divergence was unknown and not easily changed. This should improve performance.



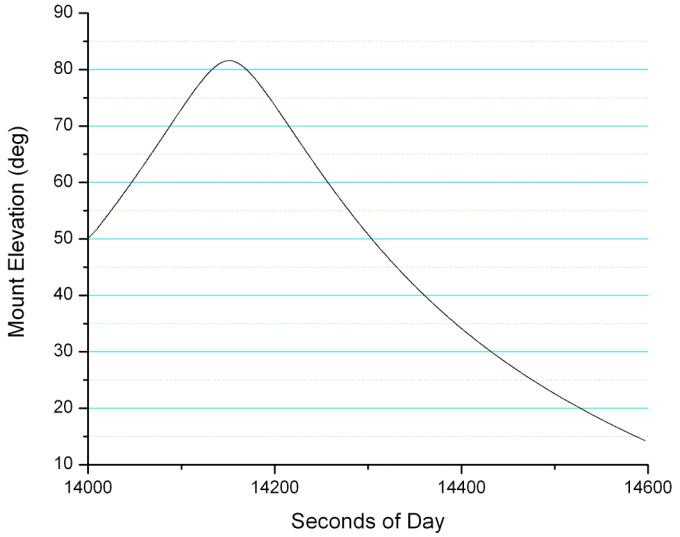
First closed-loop correction here

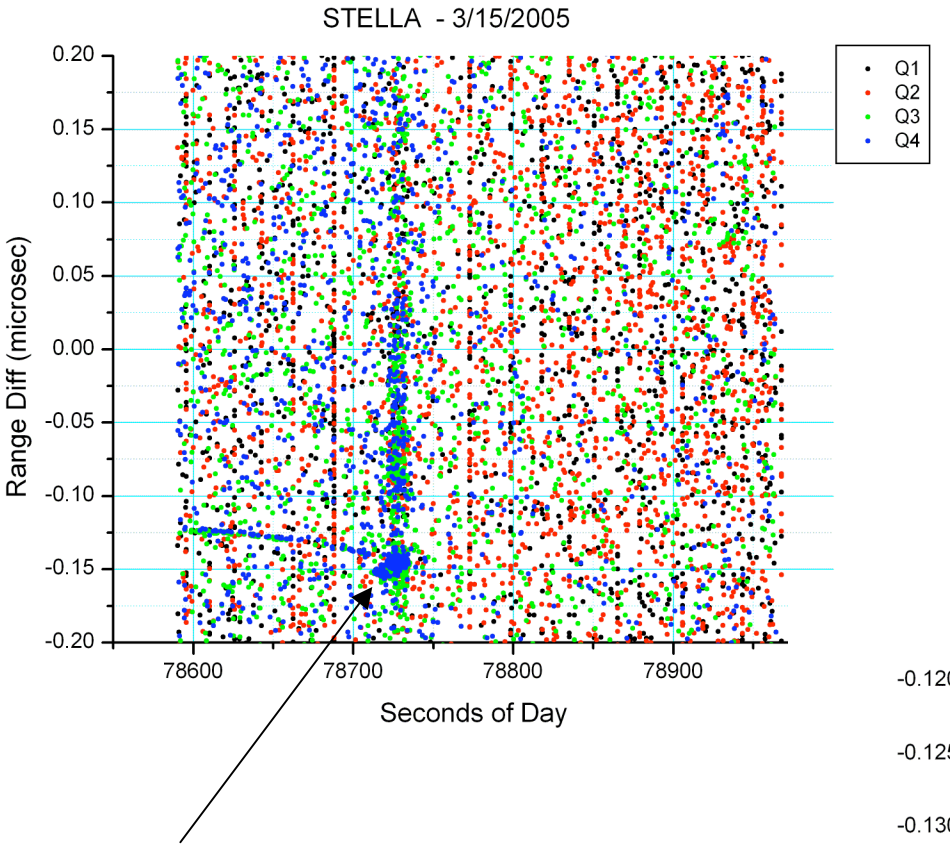
BEC pass taken on 3/14/2005 (GMT 3/15/2005 03:47).

Problem with s/w recording of range-bias cause jumps in OMC plot.

Blanking causes periodic no-noise segments.

This pass was run with closed-loop activated and working. Point-ahead version of software.





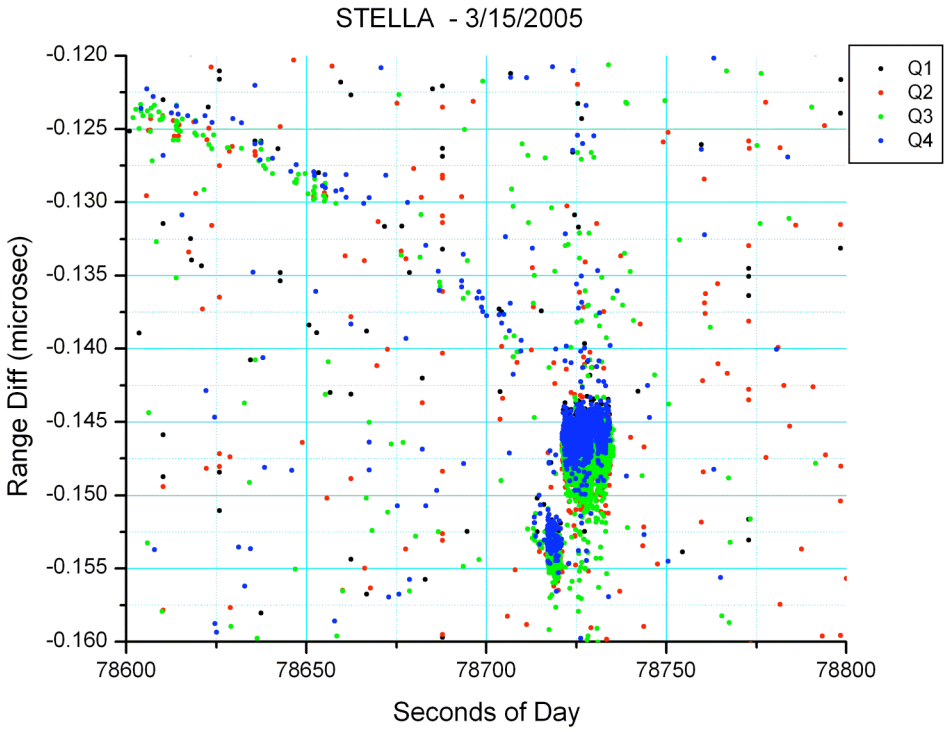
First closed-loop correction here

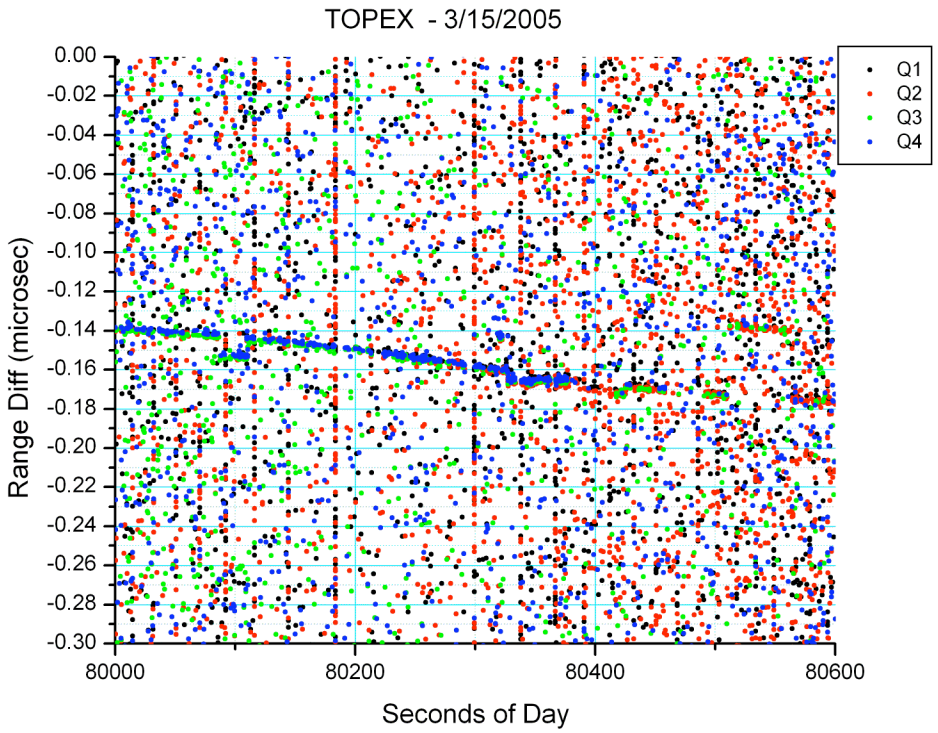
STELLA pass taken on 3/15/2005 (GMT 3/15/2005 21:46).

Problem with s/w recording of range-bias cause jumps in OMC plot.

Blanking still there – but daylight fills in gaps.

This pass was run with closed-loop activated. Point-ahead version of software.



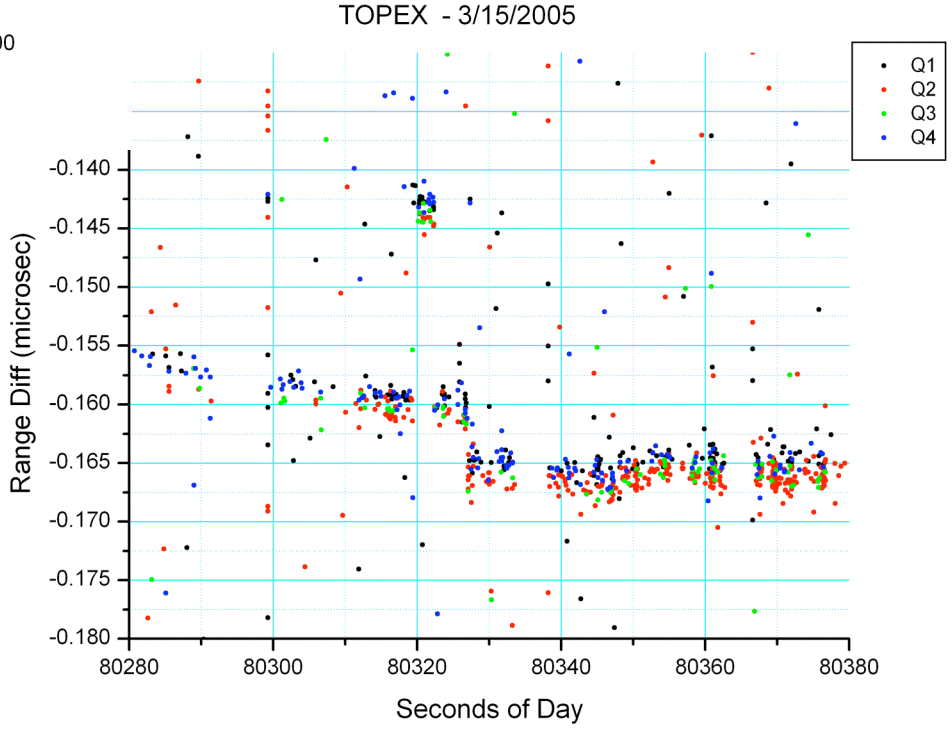


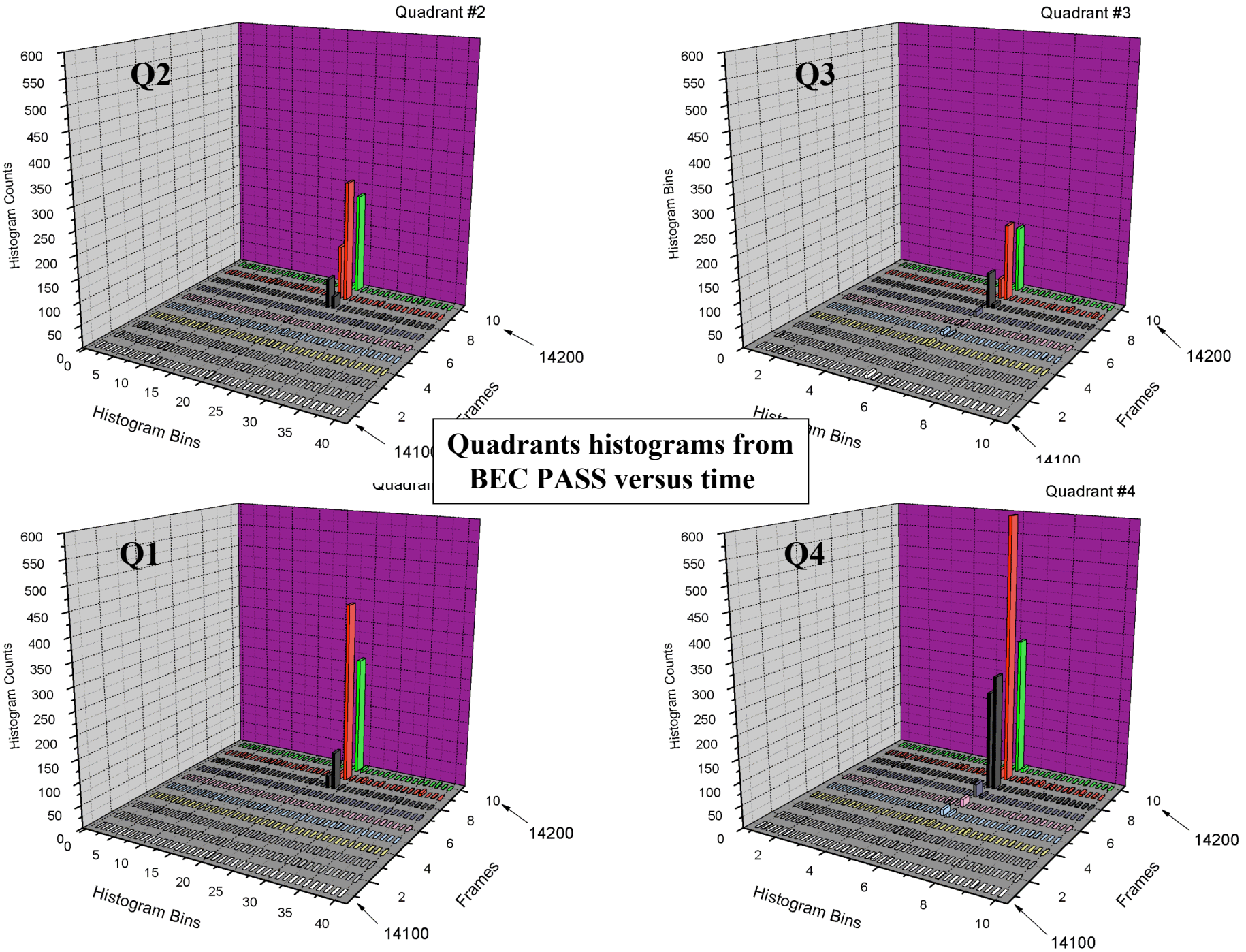
TOPEX pass taken on 3/15/2005 (GMT 3/15/2005 22:09).

Problem with s/w recording of range-bias cause jumps in OMC plot.

Blanking causes periodic no-noise segments.

This pass was run with closed-loop activated. Point-ahead version of software.





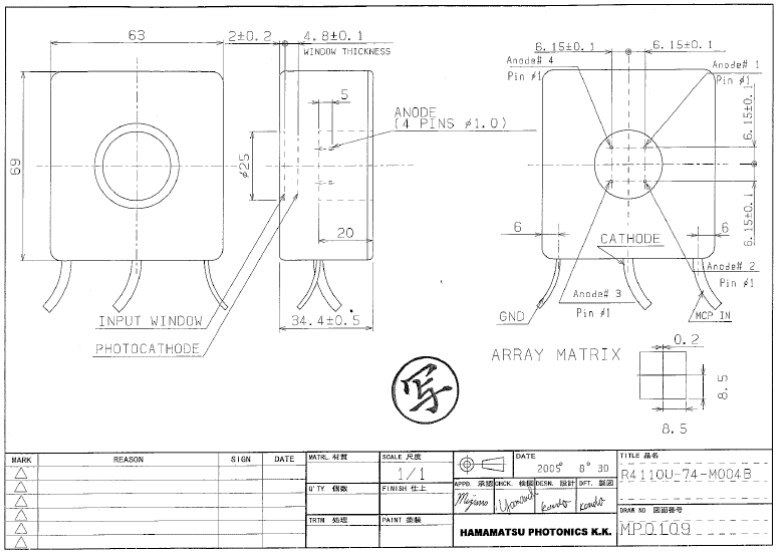
Quadrants histograms from BEC PASS versus time

Potential new S2K detector:

Four quadrant MCP.

QE >= 30%.

Price: ~ $35k.



T050830

TECHNICAL INFORMATION

SPECIFICATION SHEET

Microchannel Plate Photomultiplier Tube

R4110U-74-M004B

GENERAL

Parameter		Ratings	Units
Spectral Response		280 to 720	nm
Wavelength of Maximum Response		480 to 550	nm
Input Window	Material	Borosilicate Glass	-
	Thickness	4.77	mm
Photocathode	Material	GaAsP	-
	Minimum Effective Diameter	25	mm
Microchannel Plate (MCP) Construction		2 Stages (Filmless)	-
Anode	Pattern	Matrix 4 ch	-
	Size (each ch)	8.5 x 8.5	mm
Mechanical Size (H x W x L)		69 mm x 63 mm x 34.4 mm	-

RATINGS

Parameters		Ratings	Maximum Ratings	Units
Input Gate Pulse (Photocathode to MCPin)	Voltage	-200	-230	V
	Width	100		ns
Supply Voltage (MCPin to Anode)		2200	-	V
Photocathode Current		-	10	nA
Average Current (Each Anode)		-	200	nA
Ambient Temperature		-	-50 to +50	°C

CHARACTERISTICS

Parameters		Min.	Typ.	Max.	Units
Photocathode Sensitivity	Luminous Sensitivity	400	700	-	uA/lm
	Quantum Efficiency at Peak	30	40	-	%
DC Current Amplification at -2200 V		1 x 10^6	3 x 10^6	-	-
Anode	Dark Counts at -2200 V (25 °C) (summed all anodes)	-	-	30000	s^{-1}
Voltage Divider Current at -2200 V		-	-	100	uA
Photocathode Uniformity		50	-	-	%
MCP Gain Uniformity		50	-	-	%
Time Response (Gate on Operating)	Rise Time	-	200	300	ps
	Fall Time	-	300	-	
	T.T.S. (FWHM)	-	100	-	
Cross - Talk		-	8	-	%

HAMAMATSU

Electron Tube Division
Department #5 Aug.,2005